Space Weather Forecast

Issued on Monday, 08 May 2023 at 13:24 Local

This forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: S1/Minor Proton storm expected 08-09 May. G1/G2 (Minor-Moderate) Geomagnetic storms likely 10-11 May with a slight chance of G3/Strong storms. Further R1-R2 Radio blackouts expected.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Moderate with the largest flare an M1.6 event at 07/2323 UTC from a complex sunspot in the northwest. This was the only M-flare during the period. There are a trio of spot groups spanning the northeast to northwest centre disc. All appear to be magnetically linked. The two regions in the northern hemisphere closest to the Earth-Sun line are large and magnetically complex regions with notable potential for significant flares at this time. The region in the northwest has tended to weaken during the period with the leading spots generally fading. All other regions appear simple and stable at this time. In total there are five numbered and one unnumbered sunspot groups on the visible disc.

A full halo Coronal Mass Ejection (CME) was associated with the M1.6 flare from AR3296. Although much of the ejecta appears to be directed to the northwest an Earth-directed component is expected and has been modelled.

Solar Wind / Geomagnetic Activity: The solar wind was initially slightly elevated, near 400km/s but increased to around 450km/s from 07/1445 UTC with the arrival of a CME that left the sun on 04 May. Solar winds erratically increased further during the period to generally 450-500km/s with a peak speed of 546km/s at 07/2047 UTC. Speeds have remained elevated to slightly elevated since, with another CME arrival likely to have occurred around 07/2330 UTC. There is also a possibility that a High-Speed Stream from a coronal hole was embedded in the solar-wind. Density was average until a rise to above average was observed after 07/0700 UTC. The peak values approached 40 ppcc between 07/1300 UTC and 07/1445 UTC. Density eased thereafter, remaining above average at first but becoming average from around 08/0430 UTC. Total IMF strength, Bt, was initially weak before increasing to Moderate to Strong, peaking with the first CME arrival around 07/1500 UTC. Following this the Bt eased, becoming generally Moderate and then later Weak after approximately 08/0300 UTC. The north-south, Bz, component was largely positive, but with isolated deviations to negative, varying between moderately positive and negative in strength. Resultant Geomagnetic activity was Quiet to Active (Kp2-4).

Energetic Particles / Solar Radiation: The count rate of energetic particles (high energy protons) has remained below the S1/Minor storm threshold, although proton counts are above background levels and currently increasing close to this level.

Four-Day Space Weather Forecast Summary

Solar Activity: Isolated Moderate activity, with a slight chance of Strong activity is forecast through the next four days, mainly from the regions in the northeast to northwest centre disc.

Solar Wind / Geomagnetic Activity: A large CME was observed alongside the M1.6 flare from a sunspot group near northern centre disc at 07/2323 UTC. Although much of the ejecta appears

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to be directed towards the northwest an Earth-directed component is expected and has been modelled to arrive at Earth either on late 10 or early 11 May.

Earth may be under the influence of one or more HSS from coronal holes in the sun's western hemisphere, although this is somewhat uncertain given the recent enhancements to solar parameters due to the arrival of multiple CMEs in the past 24 hours. Elevated to slightly elevated winds should ease to background either on 09 or 10 May as the influence of the coronal hole(s) and residual CME effects wane. Some enhancement in the solar-wind may occur late on 11 May due to a coronal hole currently approaching the meridian in the northeast. Any impacts are expected to be weak based on persistence, but are more likely to be masked by the expected arrival of the CME that left the sun on 07 May, either late 10 or early 11 May. Solar winds are most likely to increase to elevated levels with the CME bringing an increased risk of significant geomagnetic activity.

On 08 and 09 May Quiet to Unsettled activity is expected with a slight chance of isolated Active intervals (08 May only). Quiet activity on 10 May should become G1-G2 (Minor to Moderate) storm conditions either late on the day or early 11 May, with a slight chance of G3 (Strong) geomagnetic storm levels being reached.

Energetic Particles / Solar Radiation: The count rate of energetic particles (high energy protons) is expected to exceed the S1/Minor Storm threshold on 08 and early 09 May before returning to ambient or near background levels in the absence of any further significant flares.

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Geomagnetic Storms:

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	1	80	80
Strong	G3	No	1	1	10	10
Severe	G4	No	1	1	3	3
Extreme	G5	No	1	1	1	1

Radio Blackouts - X Ray Flares:

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	Yes	70	70	50	50
Very Active	R3 to R5 X	No	10	10	5	5

Solar Radiation Storms - (High Energy Protons):

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	90	60	15	15
Very Active	≥ S3 *	No	3	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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